

RACE 467, A NEW VIRULENT ANTHRACNOSE PATHOTYPE IN CHIHUAHUA, MEXICO

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Co-evolution of anthracnose and the common bean has been observed (Balardin and Kelly, 1998; Sicard *et al.*, 1997) as well as the presence of large pathogenic variation. The occurrence of many pathotypes represented by individual isolates in different regions of Mexico and the wide variation in avirulence genes in the populations of this pathogen, suggest that fungal populations are composed of many pathotypes of recent origin and that new pathotypes are being developed (Rodríguez *et al.*, 2003). This observation might be related to an increased use of improved cultivars and the movement of seed and grain used as seed across and within regions.

Twenty two isolates of *C. lindemuthianum* collected between 1992 and 1996 in the state of Chihuahua from landraces of the 'ojo de cabra' seed type (Durango race), the predominant type in the 90s, were all classified as race 448 (González *et al.*, 1998). Among five isolates collected in 1997 from a single field sown with an American Pinto cv., all were race 448. Among eight isolates obtained from cv. Pinto Villa (Durango race, introduced into the state from 1992 onwards) in 1998, races 448 y 449 were identified, whereas in 1999, also race 467 was identified out of eight isolates from Pinto Villa (Rodríguez-Guerra *et al.*, 2003). From a later sampling in 2005, five different races were identified (Table 1) (Mendoza, 2008), taken together these overcome the resistance of the differentials Michelite, Michigan Dark Red Kidney, Widusa, Mexico 222, PI207262, To and AB136. All this new pathogenic variation may have arisen in response to the resistance carried by cv. Pinto Villa against race 448 (Gonzalez *et al.*, 2004). Pinto Villa's pedigree shows a Canario line (Andean pool) (Acosta *et al.*, 1995) and perhaps carries, in addition to a Mesoamerican resistant gene, an Andean allele (*Co-1*). Therefore, the newly described race 467 overcomes both Mesoamerican and Andean cultivars in the differential set. In Chihuahua, cv. Pinto Villa has already been replaced by Pinto Saltillo, a slow seed darkening cultivar that was hit by anthracnose in 2008 (race has not been defined yet). During 2008 lines from a pinto trial were exposed to pathotypes 467 (from Chihuahua) and 1472 (from Zacatecas) under controlled conditions and standard procedures. This trial included 14 lines plus check cv. Pinto Saltillo and Pinto Durango. A Second trial included 70 lines and bred cultivars Pinto Saltillo, Pinto Villa, Pinto Mestizo and Pinto Durango and was inoculated with pathotype 467. Inoculated plantlets were kept in a moist chamber 72 h and twelve days after inoculation plantlets were scored using a scale from 0 (clean plant) to 4 (dead plant) (Garrido y Romero-Cova, 1988)

In the first trial only few plantlets from lines PTB08004 and PTB08007 (both derived from the single cross (Pinto Durango/MAM 48) resulted resistant to race 467. On the basis of those results, 100 seeds of these lines plus Pinto Durango were sown and plantlets inoculated with race 467 to search for more resistant plants; due to lack of seed MAM 48 was not tested, it is being increased. From this second sowing, a few resistant plantlets were only recovered from PTB08007. Resistant plantlets were transplanted to larger pots to produce seeds. These seeds will be tested again against race 467 and if resistant, they will be further increased to be used in crosses and to develop a new version of the original line. The inoculation with race 1472 in the second trial, showed that out of 74 genotypes, a dozen lines showed heterogeneity in their response. i.e, more that four plants scored 0 out of twelve. Four out of seven lines derived from cross DON38/Azufrado Namiquipa displayed

resistant plants, and five out of eighteen lines derived from Pinto Bayacora/Pinto Saltillo also produced resistant plants. Those resistant plants were transferred to large pots to increase seed. Since all these lines display grain of high commercial quality, those that resulted heterogeneous, along with parental stocks, will be further tested to recover a resistant version of each. DON38 is a drought resistant pinto line introduced from Malawi throughout the B/C-CRSP, whereas Azufrado Namiquipa was derived from CIAT 326/85, a line introduced from CIAT. One hundred seeds of each parental stock of those lines displaying resistance will be tested along with the other lines. The four pinto cultivars Pinto Saltillo, Pinto Villa, Pinto Mestizo and Pinto Durango, resulted susceptible.

As pointed out by Miklas *et al.* (2006), the development of lines with resistance from both gene pools is a recognized strategy for developing improved, broad-base, long-lasting resistance in common bean. In this particular case, in addition to *Co-4*², the *Co-1*² allele is also needed. At the moment we do not know what resistant alleles these resistant lines might possess.

Table 1. Anthracnose pathotypes isolated in the main rainfed bean growing area in the state of Chihuahua, Mexico.

Pathotype	Year				
	1992-96	1997	1998	1999	2005
448	X	X	X		X
449			X	X	X
467				X	X
1409					X
1473					X

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